

waveform to spectrally prepare the signal for transmission over the channel 212. The analog filter may operate similarly to the transmit filter 224 but in the analog domain.

Example Sequences

In one configuration, the sequence generator 220 or other device with similar capabilities generates a sequence defined by varying the polynomial of the sequence generator to provide different sequence signals. In another configuration, the polynomial is selected to maximize the period of the sequence, such as to create an M-sequence. As described above, the period of a length-maximized sequence is defined as $2^m - 1$ where m is the number of stages of shift registers used to generate the sequence.

By varying the number of stages m , the period is controlled. Various advantages may be gained by varying the period of the sequence. For example, one advantage of increasing the period of the sequence comprises mitigation of the effects of correlated additive noise such as crosstalk. In the correlator, the noise component is decorrelated which spreads the noise across all frequencies thus reducing the amount of noise in the frequency band of interest. This improves the likelihood of accurate signal detection and accuracy of the channel analysis, if performed. Another advantage of increasing the period of the sequence is that the system can provide a more complete response thereby improving accuracy. Yet another advantage of increasing the period of the sequence is that the analysis is based on more tones with finer frequency spacing.

An advantage of a shorter period generated by using a smaller m value is that the sequence may be generated and analyzed more rapidly. This speeds the process. Another advantage of shorter period sequences is a lowering of the computational complexity in the receiver.

5 Although numerous specific sequences are provided below, it is contemplated that any type sequence may be used. The text Introduction to Spread Spectrum Communications written by Peterson, Ziemer and Borth, (Prentice Hall, 1995), which is incorporated herein in its entirety, provides a discussion on different sequences and in particular different types of M-sequences. Table 3-5, from the above-referenced text,
10 provides a list of primitive polynomials that may be used to generate the sequence. Any sequence period may be selected. Other sequence signals that are contemplated for use with the invention also exist.

In general, numerous M-sequences exist with periods that depend on the number of stages in the shift register used to generate the sequence signal. There is at least one M-
15 sequence for every integer greater than one where this integer represents the number of stages of the shift register. If more than one M-sequence exists for a given number of stages then the sequences are distinguished by the non-zero taps of the shift register. This is designated by the polynomial representation. In one embodiment of the invention, a sequence having a period of 31 is generated by a modem or other communication device,
20 which may be located at any point along a communication channel. One polynomial defined by a period of 31 is:

$$s(n) = s(n-2) \oplus s(n-5) \oplus f(n)$$

where $f(n)$ is the logical ones input to the sequence generator, $s(n-k)$ is the tap point after

5 the k -th delay element in the sequence generator and \oplus is modulo-2 addition.

Another example polynomial that may be generated by a communication terminal and is defined by a period equal to 63 is:

$$s(n) = s(n-1) \oplus s(n-6) \oplus f(n)$$

Another example polynomial that may be generated by a communication terminal and is

10 defined by a period equal to 127 is:

$$s(n) = s(n-3) \oplus s(n-7) \oplus f(n)$$

Another example polynomial that may be generated by a communication terminal and is

15 defined by a period equal to 255 is:

$$s(n) = s(n-2) \oplus s(n-3) \oplus s(n-4) \oplus s(n-8) \oplus f(n)$$

In another embodiment of the invention, a sequence having a period of 31 may be generated by a communication terminal and adopted for use as a sequence signal. One

20 polynomial defined by a period of 31 is: